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Bushfire performance of Delta Panel roof systems in accordance with AS 1530.8.1-2018 up to BAL 29

Assessment Report

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Important disclaimer

Contents

1 Introduction

This is a report of the bushfire performance of Delta Panel roof systems in accordance with AS 1530.8.1-2018 up to BAL 29.

This report is prepared for meeting the requirements of AS 3959-2018 clauses 3.4 and 3.8 and NCC 2022 Volume 2 Clause A5G3 1 (d) as appropriate to the required Bushfire Attack Level (BAL) performance.

This report reviews and confirms the extent to which the reference BAL tests listed in section 2 meet the requirements of the fire test standards listed in section 4 of the report. The proposed variations to the tested construction presented in Section 3 are subject to an analysis in Appendix B and the conclusions are presented in Section 5 of this report.

The field of applicability of the results of this assessment report is presented in Section 6 and is subject to the requirements, validity, and limitations of Sections 7, 8 and 9.

2 Supporting Data

This assessment report refers to various test reports to support the analysis and conclusions of this report. They are listed below in Table 1.

Table 1: Referenced test data

Report Reference	Test Standard	Outline of Test Specimen
FSZ 2411	AS 1530.8.1-2018	The specimen comprised a 45-degree pitched Delta Panels roof system that included a roof valley and a roof ridge detail.

The test report FSZ 2411 was undertaken by CSIRO and sponsored by Delta Panels Pty Ltd.

3 Proposed Minor Variations

The proposed construction shall be a roof system as tested in FSZ 2411, when subject to the variations listed below;

- The pitch of the roof may vary from 45 degrees tested to a roof with a pitch of 8 to 75 degrees.
- The roof panel top steel skin shall vary from the tested Delta Trim roof profile to Delta Orb roof profile as shown in Figure 1 and 2.
- The panel shall be a minimum of 100mm thick as per Figures 2 and 4.
- Variation of fixings for panel to panel
    - The fixing shall be the tested 13g x 25mm self-drilling steel screws, or larger/longer in size.
    - The fixing shall be at least 200mm centres or closer.
- Variation of fixings for panel to frame, barge edges, top the valley gutter steel skin to top of panel, ridge cap.
    - The fixing shall be the tested TEK 14g x 175mm Hex screws with cyclone clips, or larger/longer in size.
    - The fixing shall be at least 200mm centres or closer.
- Variation of fixings for bottom of valley gutter steel skin to bottom of panel.
    - The fixing shall be the tested stainless-steel rivet, or larger/longer in size.
    - The fixing shall be at least 200mm centres or closer.
- The mineral wool under the valley gutter may be as tested 50mm or thicker, with a minimum density of 38kg/m^2 as per Figure 6
- Roof framing system may vary as follows;
    - The framing may be arranged and specified to meet AS 1684 timber framing code or NASH standard – steel framed construction in a bushfire area.
    - Framing details at eaves shall exclude gaps greater than 2mm.
- The inclusion of the following sealants in all gaps including roof ribbing edges, joints on the upper and underside of the roof panel, valley gutter, barges, ridge, hips, and drip edges.
    - Boss FireSilicone-EMA sealant (as tested) or other fire-resistant silicone sealants such as Sikasil 670 Fire Silicone Sealant.

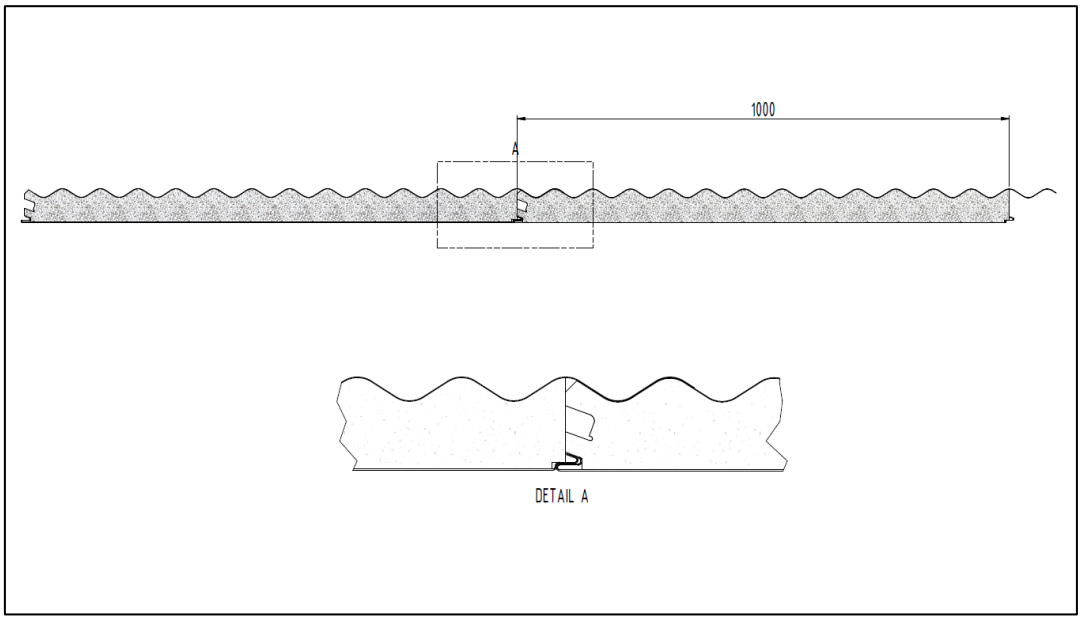

Figure 1 – DeltaOrb Panel Assembly– Section view

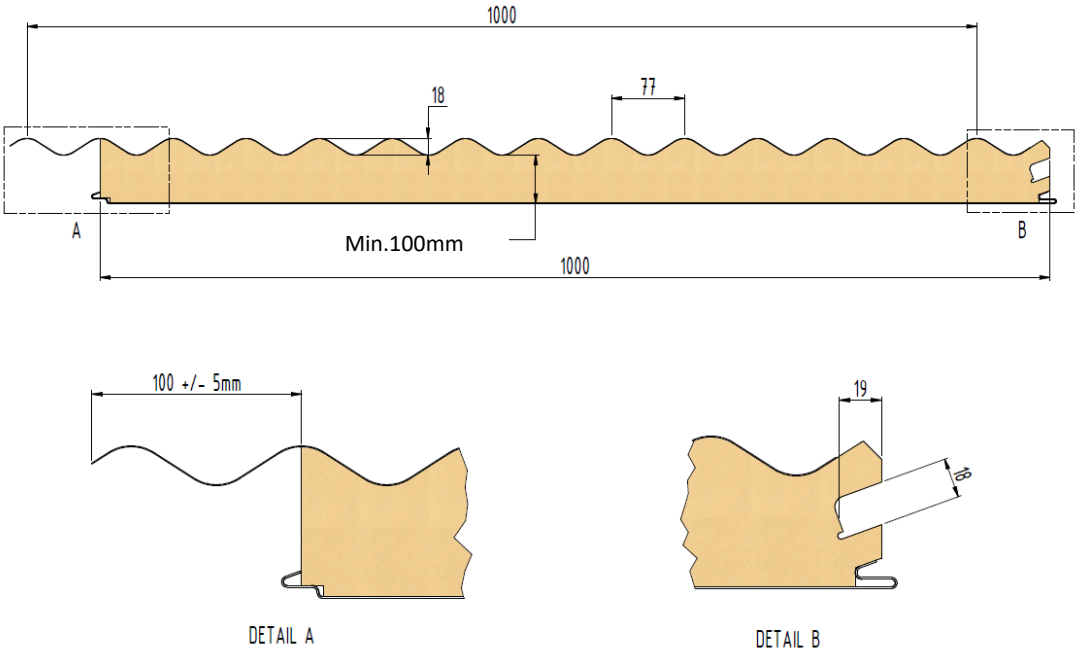

Figure 2 – Single DeltaOrb Panel detail– Section view

Figure 3 – Single DeltaOrb Panel detail– Isometric view

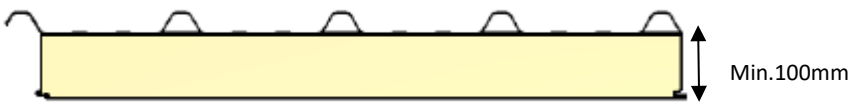

Figure 4 – Single DeltaTrim Panel detail – Section view

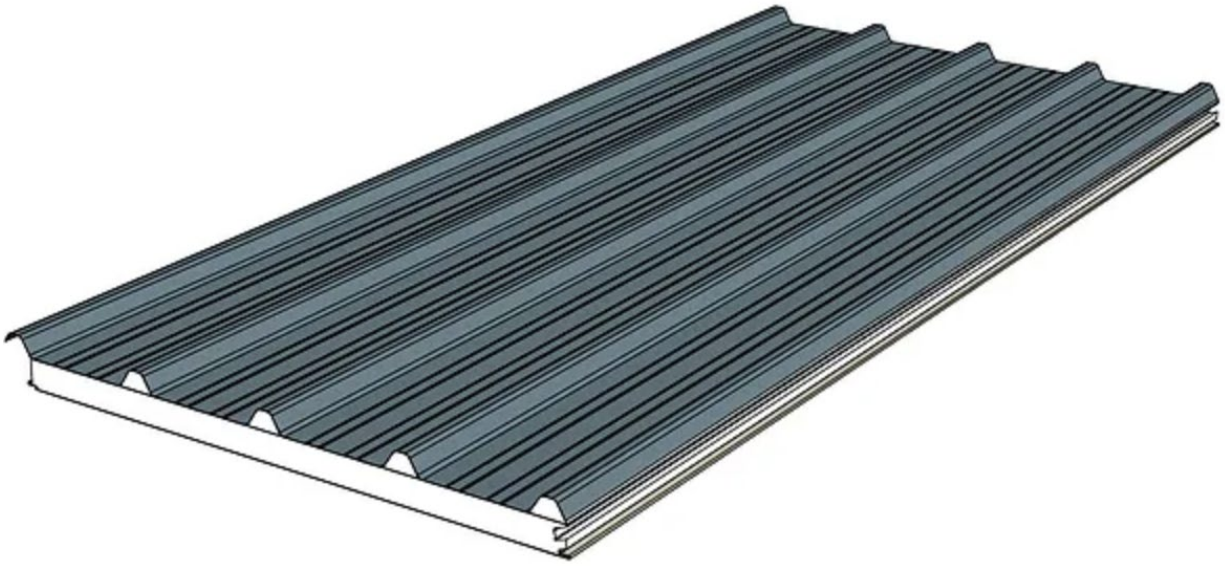

Figure 5 – Single DeltaTrim Panel detail – Isometric view

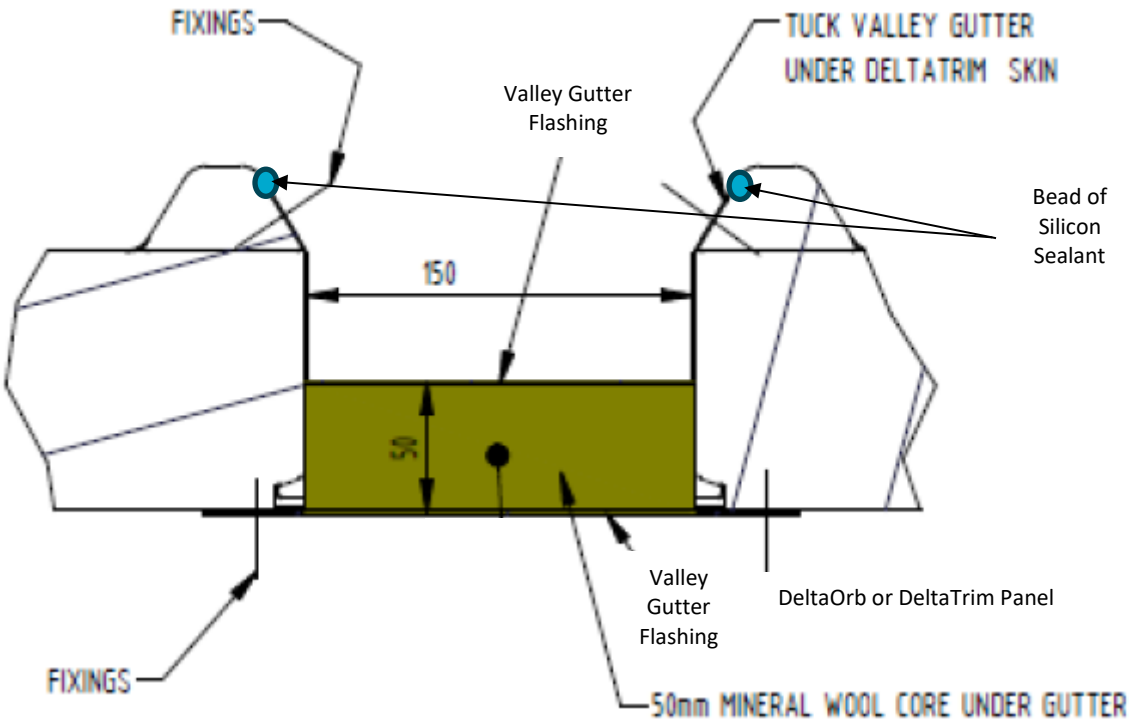

Figure 6 – valley gutter detail for DeltaTrim panel – Isometric view (DeltaOrb panel similar)

4 Referenced Standards

Standards:

AS 1530.8.1-2018	Methods for fire tests on building materials, components and structures - Tests on elements of construction for buildings exposed to simulated bushfire attack - Radiant heat and small flaming sources

5 Conclusion

Based on the analysis presented in this report, it is the opinion of this Accredited Testing Laboratory that the tested prototypes described in Section 2 when varied as described in Section 3 will achieve the BAL performance stated below when submitted to a test in accordance with the test method referenced in Section 4 and subject to the requirements of Section 7, the validity of Section 8 and limitation of section 9.

Table 2: BAL performance of Delta panel roof systems

Framing	Roof pitch	Panel profile	Figures	BAL performance
Timber framing in accordance with AS 1684 or Steel framing in accordance with NASH standard	8-75 degrees	Delta Trim roof profile	4, 5 and 6	Up to BAL: AA29
		Delta Orb roof profile	1, 2, 3 and 6	

6 Direct Field of Application of Results

The results of this report apply to roofs exposed to the effects of bushfire from the side tested in the referenced test.

7 Requirements

Any variations with respect to size, constructional details, loads, stresses, and edge or end conditions that are other than those identified in this report, may invalidate the conclusions drawn in this report.

8 Term of Validity

This assessment report will lapse on 30th April 2029. Should you wish us to re-examine this report with a view to the possible extension of its term of validity, would you please apply to us three to four months before the date of expiry. This Division reserves the right at any time to amend or withdraw this assessment in the light of new knowledge.

9 Limitations

The conclusions of this assessment report may be used to directly assess the fire performance under such conditions, but it should be recognised that a single test method will not provide a full assessment of the fire hazard under all fire conditions.

Because of the nature of fire testing, and the consequent difficulty in quantifying the uncertainty of measurement, it is not possible to provide a stated degree of accuracy. The inherent variability in test procedures, materials and methods of construction, and installation may lead to variations in performance between elements of similar construction.

This assessment report does not provide an endorsement by CSIRO of the actual products supplied to the industry. The referenced assessment can therefore only relate to the actual prototype test specimens, testing conditions and methodology described in the supporting data, and does not imply any performance abilities of constructions of subsequent manufacture.

This assessment is based on information and experience available at the time of preparation. The published procedures for the conduct of tests and the assessment of test results are the subject of constant review and improvement and it is recommended that this report is reviewed on or, before, the stated expiry date.

The information contained in this assessment report shall not be used for the assessment of variations other than those stated in the conclusions above. The assessment is valid provided no modifications are made to the systems detailed in this report. All details of construction should be consistent with the requirements stated in the relevant test reports and all referenced documents.

Appendix A Supporting Test Data

A.1. CSIRO report numbered FSZ 2411

On 18 October 2023, CSIRO conducted a bushfire test in accordance with AS 1530.8.1 – 2018 on a 45-degree pitched steel framed roof clad with Delta Panels that measured nominally 2000 mm wide x 1550mm deep that incorporated a 150mm wide x 50mm thick valley gutter located 450mm from the right barge edge of the exposed face. The pitch of the roof systems was 45 degrees.

Specimen Detail

The roof was fabricated from three 100-mm thick DeltaTrim-TPC panels cut to 1550-mm length, the centre of the roof used a full width panel measuring 1000-mm wide (DeltaTrim-TPC Opp Cut), and two part width panels measuring 400-mm wide (DeltaTrim-TPC LH Cut) and 450-mm wide (DeltaTrim-TPC RH Cut) were used on the left and right hand edges of the roof respectively. The DeltaTrim-TPC panels comprised a thermosetting phenolic composite core (TPC) with a stated density of 38-42 kg/m^3. The core was bonded on both sides to 0.6-mm thick roll formed steel skins using two-part polyurethane adhesive, the underside of the panel was flat, and the top steel skin had a Trimdeck profile.

The bottom edge of the DeltaTrim-TPC panels were protected with profiled 1.2-mm thick roll formed steel skin DeltaTrim Fascia flashing (TPC-003) fixed with 13g x 25-mm self-drilling steel screws at 200-mm centres , and the exposed roof ribbing edges were covered with Delta TrimEnd Caps (TPC-R015) that were fully sealed with Boss FireSilicone-EMA sealant. The DeltaTrim-TPC panels were fixed to the steel frame using TEK 14 x 175 Hex screws and cyclone clips. All the joints on the underside of the roof were filled with a bead of FireSilicone-EMA sealant.

The left and right barge edges of the roof were fitted with x 0.6-mm thick roll formed profiled steel skin DeltaTrim 100-mm side barge trims (TPC-R006 and TPC-006-RH) fixed with TEK 14 x 175 Hex screws at 200-mm centres.

The right side of the roof incorporated a 150-mm wide valley gutter located 450-mm from the right barge edge. The valley gutter consisted of a 50-mm thick x 150-mm wide mineral wool core with a stated density of 38-42 kg/m^3 covered on the top side with a 30-mm x 50-mm 150-mm wide x 0.6-mm thick roll formed steel skin (TPC-R005) fixed with Tex screws at 200-mm centres and a 230-mm wide x 0.6-mm thick roll formed steel skin Valley gutter flashing (TPC-R010) on the underside fixed with stainless steel rivets at 200-mm centres and the edges covered with FireSilicone-EMA sealant.

Located at the ridge of the roof was a x 0.6-mm thick roll formed profiled steel skin ridge cap (TPC-R014) fixed screws. All exposed gaps between the DeltaTrim-TPC panels and the ridge cap and the fibre cement sheeting on the sides were filled with a bead of FireSilicone-EMA sealant.

The roof specimen was fitted with a 120-mm wide x 140-mm high standard steel roof gutter.

The roof structure was enclosed at the back of the test frame with oriented strand board (OSB) that incorporated a 100-mm x 100-mm vent opening located at the base of the roof and a 200-mm x 200-mm glass vision panel.

Support construction

The Delta Panels roof system was fixed to a DeltaTrim TPC test frame (TPC-R011) that measured 2040-mm wide x 880-mm deep x 1590-mm high at the back and 480-mm high at the front, fabricated using 65-mm x 65-mm SHS, 50-mm x 50-mm x 3-mm thick angled base and 1.2-mm BMT Beam cap (200-BEAM) located at the top. The test frame was lined on both sides and the bottom with 6-mm thick fibre cement sheeting (TPC-R009 and TPC-R013) and a 100-mm thick DeltaCool -TPC insulated panel wall at the front.

Orientation

The roof specimen was tested with the exterior face of the roof exposed to the radiant heat source.

Crib size

The crib size selected by the test sponsor for the relevant BAL level was Class AA, as specified in Table 3.2 of Section 3.8 of AS 3959:2018.

Four cribs were used for the test, crib #1 was positioned in the roof gutter adjacent to the ridge edge of the valley gutter, while Cribs #2 and 3 were positioned in the valley gutter 700-mm and 1200-mm from the drip edge. Crib # 4 was positioned just below the ridge cap detail mid span.

Performance observed in respect of Clause 14.4 of AS 1530.8.1-2018 criteria:

Performance Criteria		**Time to failure (min)**	**Position of failure**
A gap from the fire exposed face to the non-fire exposed face greater than 3mm		No Failure	-
Sustained flaming for 10 seconds on the non-fire side		No failure	-
Flaming on the fire-exposed side at the end of the 60 minutes test period		No failure	-
Radiant heat flux 365mm from the non-fire side exceeding 15-kW/m²		Not Applicable	-
Mean and maximum temperature rises greater than 140 K and 180 K		No failure	-
Radiant heat flux 250mm from the specimen, greater than 3-kW/m² between 20 minutes and 60 minutes		No failure	-
Mean and maximum temperature of internal faces exceeding 250°C and 300°C respectively between 20 minutes and 60 minutes after the commencement of the test		Not Applicable	-
Crib class	**AA**	**Peak heat flux**	**29 kW/m²**

For the purpose of building regulations in Australia, the test specimen achieved a **Bushfire Attack Level (BAL) of AA29**.

Appendix B Analysis of Minor Variations

B.1 Variation to tested construction

The proposed construction shall be a roof system as tested in FSZ 2411 when subject to the variations listed below;

- The pitch of the roof may vary from 45 degrees tested to a roof with a pitch of 8 to 75 degrees.
- The roof panel top steel skin shall vary from the tested Delta Trim roof profile to Delta Orb roof profile as shown in Figure 1 and 2.
- The panel shall be a minimum of 100mm thick as per Figures 2 and 4.
- Variation of fixings for panel to panel
    - The fixing shall be the tested 13g x 25mm self-drilling steel screws, or larger/longer in size.
    - The fixing shall be at least 200mm centres or closer.
- Variation of fixings for panel to frame, barge edges, top the valley gutter steel skin to top of panel, ridge cap.
    - The fixing shall be the tested TEK 14g x 175mm Hex screws with cyclone clips, or larger/longer in size.
    - The fixing shall be at least 200mm centres or closer.
- Variation of fixings for bottom of valley gutter steel skin to bottom of panel.
    - The fixing shall be the tested stainless-steel rivet, or larger/longer in size.
    - The fixing shall be at least 200mm centres or closer.
- The mineral wool under the valley gutter may be as tested 50mm or thicker, with a minimum density of 38kg/m^2 as per Figure 6.
- Roof framing system may vary as follows;
    - The framing may be arranged and specified to meet AS 1684 timber framing code or NASH standard – steel framed construction in a bushfire area.
    - Framing details at eaves shall exclude gaps greater than 3mm.
- The inclusion of the following sealants in all gaps including roof ribbing edges, joints on the upper and underside of the roof, valley gutter, barges, ridge, hips, and drip edges.
    - Boss FireSilicone-EMA sealant (as tested) or other fire-resistant silicone sealants such as Sikasil 670 Fire Silicone Sealant.

Roof pitch variation

The proposed construction includes a roof that has a pitch that varies as follows:

- The pitch of the roof may vary from 45 degrees tested to a roof with a pitch of 8 to 75 degrees.

With reference to FSZ 2411, the roof pitch was tested at 45 degrees. Sustained flaming or gap formation was not observed during the test.

With reference to AS 1530.8.1-2018 clause 17.2, it requires roof systems with a steep pitch to be evaluated separately from roof systems with a shallow pitch.

With reference to AS 1530.8.1-2018 clause 17.6, it stipulates that if the roof with a pitch of 45 degrees has been tested, the result shall apply to roofs with a gradient of more than 18 degrees and less than 75 degrees. The tested roof system in FSZ 2411 and the above discussion confirms that the proposed system meets this requirement.

With reference to AS 1530.8.1-2018 clause 17.6, it also stipulates that the roof with a pitch of 18 degrees that has been tested, the result shall apply to roofs with a gradient up to 18 degrees. The

proposed variation would require the roof tested in FSZ 2411 with the valley gutter to be configured and tested in this way.

When the roof is tested at a lower pitch, it is generally less severe as the incident radiation is significantly reduced per meter square of room.

With reference to AS 1530.8.1-2018 clause 17.4.1, it stipulates that when a roof is tested with a pitch of 18 degrees, aside from the cribs required for a roof tested with a pitch of 45 degrees, it shall have an additional crib over a joint at 750mm from the facia.

It was observed that in FSZ 2411, there was no crib place at the joint in the roof panel system at 750mm from the facia. The joint can be a location of weakness where the heat of the crib can penetrate through the panel, leading to flaming or insulation failure at the back of the panel.

However, it is observed that the tested panel profile and the proposed panel profile both has a small section of metal sheet which overlaps at the panel joint, which allow this joint to in a similar heating condition as the rest of the panel. Furthermore, the back of the joint would be sealed with silicon sealant as tested in FSZ 2411 which would further prevent heat of the crib from causing the thermocouple required at the joint to reach insulation failure.

Based on the above, it is expected that if the roof tested in FSZ 2411 was tested at 18 degree pitch, it will also meet the requirements of BAL 29. Based on the above, it is expected that the proposed construction will not detrimentally affect the performance of the tested roof system when tested in accordance with AS 1530.8.1-2018.

Roof panel top steel skin and panel thickness variation

The proposed construction includes the roof panel top steel skin varied from the tested DeltaTrim roof as shown in Figures 4 and 5, profile to DeltaOrb roof profile as shown in Figures 1-3. The panel shall be a minimum of 100mm thick as per Figures 2 and 4.

With reference to FSZ 2411, DeltaTrim panels were installed on top of the roof frame with a Trimdeck profile. Throughout the test, the profile of top steel skin of the panel did not contribute to flaming or caused gaps to form. It is also confirmed that the panel joints are of the same design with the same kind of profiled metal sheeting overlap at the joint. It is expected that the proposed alternative steel skin profile will also function in the same manner as the tested skin, and not cause flaming or caused gaps to form for the duration of the test.

It is observed that the thickness of the proposed DeltaOrb panel discounting the curved section of the panel, is at least 100mm, which is the same as that tested in FSZ 2411. The additional thermosetting phenolic composite core (TPC) in the curved section of the panel is expected to absorb more heat than the empty profile of the DeltaTrim panels.

It is also expected that the increase in the base panel thickness discounting the curved/trapezed section of the panel, would also improve the panel's overall insulation performance.

Based on the above, it is expected that the proposed construction will not detrimentally affect the performance of the tested roof system when tested in accordance with AS 1530.8.1-2018.

Variation of panel to panel fixing

The proposed construction includes following panel to panel fixing variations as follows:

- The fixing shall be the tested 13g x 25mm self-drilling steel screws, or larger/longer in size.
- The fixing shall be at least 200mm centres or closer

With reference to FSZ 5411, the bottom edge of the DeltaTrim-TPC panels were protected with profiled 1.2-mm thick roll formed steel skin DeltaTrim Fascia flashing (TPC-003) fixed with 13g x 25-mm self-drilling steel screws at 200-mm centres. The fixings held the panels together and did not allow for gap formation during the test.

The proposed fixings are the same as tested or larger/longer in size and fixed at least 200mm centres or closer. The increase in size and length of the fixing will add more stability to the panels and will not contribute to flaming or causes gaps to form. Similarly, the reduction of fixing centres than the tested 200mm will further reduce the possibility of gap formation and will not contribute to flaming either.

Based on the above, it is expected that the proposed construction will not detrimentally affect the performance of the tested roof system when tested in accordance with AS 1530.8.1-2018.

Variation of fixings for panel to frame, barge edges, top of the valley gutter steel skin to top of panel, ridge cap.

The proposed construction includes variation of fixings for panel to frame, barge edges, top the valley gutter steel skin to top of panel, ridge cap as follows:

- The fixing shall be the tested TEK 14g x 175mm Hex screws with cyclone clips, or larger/longer in size.
- The fixing shall be at least 200mm centres or closer.

With reference to FSZ 2411, the DeltaTrim-TPC panels were fixed to the steel frame using TEK 14 x 175mm Hex screws and cyclone clips and the left and right barge edges of the roof were fitted with x 0.6-mm thick roll formed profiled steel skin DeltaTrim 100-mm side barge trims (TPC-R006 and TPC-006-RH) fixed with TEK 14 x 175 Hex screws at 200-mm centres. The fixings and the clips held in place the panels to frame, barge edges and top of the valley gutter steel skin to top of panel, and ridge cap during the test preventing potential gap formation.

The proposed fixings are the same as tested with cyclone clips, or larger/longer in size and fixed at least 200mm centres or closer. The increase in size and length of the fixing will add more stability to the components fixed together using the proposed fixings and will not contribute to flaming or causes gaps to form. Similarly, the reduction of fixing centres than the tested 200mm will further reduce the possibility of gap formation and will not contribute to flaming either.

Based on the above, it is expected that the proposed construction will not detrimentally affect the performance of the tested roof system when tested in accordance with AS 1530.8.1-2018.

Variation of fixings for bottom of valley gutter steel skin to bottom of panel

The proposed construction includes variation of fixings for bottom of valley gutter steel skin to bottom of panel as follows:

- The fixing shall be the tested stainless-steel rivet, or larger/longer in size.
- The fixing shall be at least 200mm centres or closer.

With reference to FSZ 2411, a 230-mm wide x 0.6-mm thick roll formed steel skin Valley gutter flashing (TPC-R010) on the underside was fixed with stainless steel rivets at 200-mm centres. The fixings held the valley gutter skin and the bottom of panel together preventing gap formation during the test.

The proposed fixings are the same as tested or larger/longer in size and fixed at least 200mm centres or closer. The increase in size and length of the fixing will add more stability and will not contribute to flaming or causes gaps to form. Similarly, the reduction of fixing centres than the tested 200mm will further reduce the possibility of gap formation and will not contribute to flaming either.

Based on the above, it is expected that the proposed construction will not detrimentally affect the performance of the tested roof system when tested in accordance with AS 1530.8.1-2018.

Variation to mineral wool density

The proposed construction includes mineral wool under the valley gutter which may be as tested 50mm or thicker, with a minimum density of 38kg/m^2 .

With reference to FSZ 2411, the valley gutter consisted of a 50-mm thick x 150-mm wide mineral wool core with a stated density of 38-42 kg/m^3 covered on the top side with a 30-mm x 50-mm 150-mm wide x 0.6-mm thick roll formed steel skin (TPC-R005) fixed with Tex screws at 200-mm centres.

Throughout the test, the mineral wool under the metal valley gutter did not contribute to flaming or caused gaps to form. It is expected that the increase in density of the mineral wool will improve the insulation performance.

Based on the above, it is expected that the proposed construction will not detrimentally affect the performance of the tested roof system when tested in accordance with AS 1530.8.1-2018.

Variation to sealant

The proposed construction includes following sealants in all gaps including roof ribbing edges, joints on the upper and underside of the roof panel, valley gutter, barges, ridge, hips, and drip edges.

- Boss FireSilicone-EMA sealant (as tested) or other fire-resistant silicone sealants such as Sikasil 670 Fire Silicone Sealant.

With reference to FSZ 2411, the exposed roof ribbing edges were covered with Delta TrimEnd Caps (TPC-R015) that were fully sealed with Boss FireSilicone-EMA sealant. All the joints on the upper and underside of the roof panel were filled with a bead of FireSilicone-EMA sealant. When exposed to BAL 29 radiation, the sealants did not cause flaming for the duration of the test. The upper side sealants where were exposed directly to the crib and also radiant heat, and did not get involved in the burning behaviour of the specimen when tested. This demonstrates that silicone based sealants would not cause flaming or gap formation for the test duration.

The proposed sealants are all fire-resistant silicone-based sealant and, in that way, similar to the tested sealant.

Based on the above, it is expected that the proposed construction will not detrimentally affect the performance of the tested roof system when tested in accordance with AS 1530.8.1-2018.

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